

THIS REPORT HAS BEEN DELIMITED  
AND CLEARED FOR PUBLIC RELEASE  
UNDER DOD DIRECTIVE 5200.20 AND  
NO RESTRICTIONS ARE IMPOSED UPON  
ITS USE AND DISCLOSURE.

**DISTRIBUTION STATEMENT A**

APPROVED FOR PUBLIC RELEASE;  
DISTRIBUTION UNLIMITED.

# Armed Services Technical Information Agency

Because of our limited supply, you are requested to return this copy WHEN IT HAS SERVED YOUR PURPOSE so that it may be made available to other requesters. Your cooperation will be appreciated.

**AD**

**45758**

NOTICE: WHEN GOVERNMENT OR OTHER DRAWINGS, SPECIFICATIONS OR OTHER DATA ARE USED FOR ANY PURPOSE OTHER THAN IN CONNECTION WITH A DEFINITELY RELATED GOVERNMENT PROCUREMENT OPERATION, THE U. S. GOVERNMENT THEREBY INCURS NO RESPONSIBILITY, NOR ANY OBLIGATION WHATSOEVER; AND THE FACT THAT THE GOVERNMENT MAY HAVE FORMULATED, FURNISHED, OR IN ANY WAY SUPPLIED THE DRAWINGS, SPECIFICATIONS, OR OTHER DATA IS NOT TO BE REGARDED BY ANY PERSON OR CORPORATION, OR CONVEYING ANY RIGHTS OR PERMISSION TO MANUFACTURE, OR SELL ANY PATENTED INVENTION THAT MAY IN ANY WAY BE RELATED THERETO.

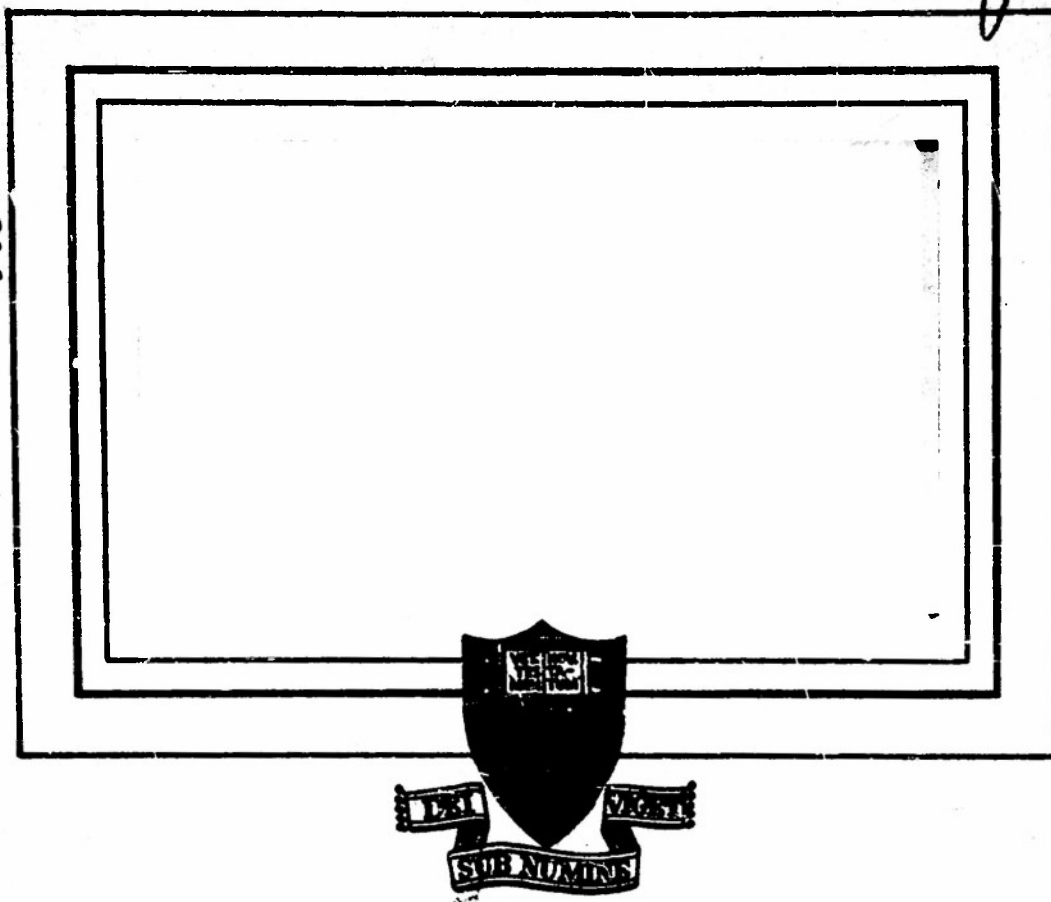
Reproduced by  
**DOCUMENT SERVICE CENTER**  
KNOTT BUILDING, DAYTON, 2, OHIO

**UNCLASSIFIED**

AD No. 45 758

ASTIA FILE COPY

22C /



PRINCETON UNIVERSITY

NR 019 117

Contract N6-ori-105, Task Order IV

Dielectric Properties and the Structure  
of Matter

Charles P. Smyth, Project Leader

Report No. 32

Periodic Status Report

April 1 - June 30  
1953

Department of Chemistry

Princeton University

U.S. Navy Department

Office of Naval Research

Dielectric Properties and the Structure of Matter  
Periodic Status Report, April 1 - June 30, 1953

Charles P. Smyth

Mr. A Di Giacomo, after one year on the Project as an Assistant in Research and two years of collaboration with the Project program on a fellowship, has received his Ph.D. degree and taken a position with E.I. Du Pont de Nemours & Co. The results of most of his investigations of dipole moments and molecular orientation in solids will be prepared for publication during the next year.

Further alterations have been made in the apparatus for the investigation of crystalline solids at 3.2 cm. wavelength. The apparatus has been extensively recalibrated and measurements have been started. An appreciable loss has been found in the low temperature solid phase of *t*-butyl chloride, which may be due to traces of hydrogen chloride. Work has been started upon dl - camphor.

Measurements of dielectric constant and dielectric loss at 1.2 cm. wavelength have been made by Mr. R.S. Holland on solutions of 2,2-dinitropropane in heptane and nujol solutions, and on 2,2-dichloropropane in heptane solution in a continuation of the study of the dielectric properties of substituted methanes. The results of the measurements on the 2,2-dinitropropane - heptane system have been combined with refractive index <sup>data</sup> and/or obtained by Dr. G.N. Roberts at wavelengths of 6.6, 10 and 30 cm. to yield Cole and Cole plots at temperatures of 2°, 20° and 40°. The following values of the distribution constant  $\alpha$  and critical wavelength  $\lambda_m$  were obtained:

2°	$\alpha = 0.01$	$\lambda_m = 0.70$ cm.
20°	$\alpha = 0.02$	$\lambda_m = 0.56$ cm.
40°	$\alpha = 0.01$	$\lambda_m = 0.49$ cm.

Complete calculations have not yet been made on the other two systems, however, the data on the 2,2-dinitropropane-nujol system seem to indicate a critical wavelength of slightly over 1.2 cm., and also a considerable atomic polarization, since the refractive index point does not agree well with the microwave points. However, this discrepancy may be due to some other effect, since the refractive index point agrees well with the microwave points when heptane is used as the solvent.

Mr. A. Tulinskie has obtained a dipole moment  $0.42 \times 10^{-18}$  and an atomic polarization 7.9 cc. for perfluorodiethyl ether in the vapor state, values which are consistent with those reported in the last Periodic Status Report for perfluorodimethyl ether. An apparently consistent series of measurements gave for perfluoropropylene a moment value 0.46 and an atomic polarization 14.3, which is so high that the measurements will be repeated.

## Scientific Paper July 1 - June 30, 1953

"Microwave Absorption and Dielectric Relaxation in Some Long-Chain Esters," by P.L. McGeer, A.J. Curtis, G.B. Rathmann and C.P. Smyth. Presented before the American Physical Society, Denver, Col., July 1, 1952.

"Microwave Absorption and Molecular Structure in Liquids. VIII, Dielectric Relaxation in Some Long-Chain Esters," by P.L. McGeer, A.J. Curtis, G.B. Rathmann and C.P. Smyth, Journal of the American Chemical Society, 74, 3541 (1952).

"Microwave Absorption and Molecular Structure in Liquids. IX. Measurement in Organic Halides at 10 cm. Wavelength," by F.H. Branin, Jr. and C.P. Smyth.

Journal of Chemical Physics, 20, 1121 (1952).

"A Calculation of the Static Dielectric Constant of Ice," by J.G. Powles, Journal of Chemical Physics, 20, 1302 (1952).

"Dielectric Relaxation in d-Camphor," by J.G. Powles, Journal of Chemical Physics, 20, 1648 (1952).

"The Dipole Moments and Molecular Structures of Cycloheptatrienone and Three Tetracyclones," by Armand Di Giacomo and Charles P. Smyth, Journal of the American Chemical Society, 74, 4411 (1952).

"The Determination of Complex Dielectric Constants of Absorptive Liquids by Microwave Interferometry," by Franklin H. Branin, Jr., Journal of Applied Physics, 23, 990 (1952).

"Dielectric Dispersion in the Microwave Region of Six Tetrasubstituted Methanes in the Solid State," by J.G. Powles, D.E. Williams and C.P. Smyth, Journal of Chemical Physics, 21, 136 (1953).

"The Dipole Moments and Structures of cis- and trans-1,2-Dichlorocyclohexane," by A. Tulinski, A. Di Giacomo and C.P. Smyth. Accepted for publication by the Journal of the American Chemical Society.

Distribution List

Chief of Naval Research  
Navy Department  
Washington 25, D.C.  
Attention: Physics Branch

5 copies

Commanding Officer  
U.S. Navy  
Office of Naval Research  
New York Branch Office  
346 Broadway  
New York 13, New York

1 copy

Princeton University  
Princeton, New Jersey  
Attention: Dean H.S. Taylor, Professor N.H. Furman  
Mr. R.J. Woodrow

1 copy each

# Armed Services Technical Information Agency

Because of our limited supply, you are requested to return this copy WHEN IT HAS SERVED YOUR PURPOSE so that it may be made available to other requesters. Your cooperation will be appreciated.

# AD

# 45758

NOTICE: WHEN GOVERNMENT OR OTHER DRAWINGS, SPECIFICATIONS OR OTHER DATA ARE USED FOR ANY PURPOSE OTHER THAN IN CONNECTION WITH A DEFINITELY RELATED GOVERNMENT PROCUREMENT OPERATION, THE U. S. GOVERNMENT THEREBY INCURS NO RESPONSIBILITY, NOR ANY OBLIGATION WHATSOEVER; AND THE FACT THAT THE GOVERNMENT MAY HAVE FORMULATED, FURNISHED, OR IN ANY WAY SUPPLIED THE SAID DRAWINGS, SPECIFICATIONS, OR OTHER DATA IS NOT TO BE REGARDED BY IMPLICATION OR OTHERWISE AS IN ANY MANNER LICENSING THE HOLDER OR ANY OTHER PERSON OR CORPORATION, OR CONVEYING ANY RIGHTS OR PERMISSION TO MANUFACTURE, USE OR SELL ANY PATENTED INVENTION THAT MAY IN ANY WAY BE RELATED THERETO.

Reproduced by  
**DOCUMENT SERVICE CENTER**  
KNOTT BUILDING, DAYTON, 2, OHIO

# UNCLASSIFIED